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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/600,417	06/19/2003	David Alan Burton	Pillar 711	7009
7590	07/12/2005		EXAMINER	
Robert Moll 1173 St. Charles Court Los Altos, CA 94024			WALTER, CRAIG E	
			ART UNIT	PAPER NUMBER
			2188	

DATE MAILED: 07/12/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b>	<b>Applicant(s)</b>
	10/600,417	BURTON ET AL.
	<b>Examiner</b>	<b>Art Unit</b>
	Craig E. Walter	2188

– The MAILING DATE of this communication appears on the cover sheet with the correspondence address –  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM  
THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1) Responsive to communication(s) filed on 19 July 2004.  
 2a) This action is FINAL.                    2b) This action is non-final.  
 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4) Claim(s) 1-25 is/are pending in the application.  
 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.  
 5) Claim(s) \_\_\_\_\_ is/are allowed.  
 6) Claim(s) 1,2,4,6,7,9,10,12-17,19 and 25 is/are rejected.  
 7) Claim(s) 3,5,8,11,18 and 20-24 is/are objected to.  
 8) Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

9) The specification is objected to by the Examiner.  
 10) The drawing(s) filed on 19 June 2003 is/are: a) accepted or b) objected to by the Examiner.  
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).  
 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
 a) All    b) Some \* c) None of:  
 1. Certified copies of the priority documents have been received.  
 2. Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)	4) <input type="checkbox"/> Interview Summary (PTO-413)
2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)	Paper No(s)/Mail Date. _____
3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date <u>2/11/04</u> .	5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)
	6) <input type="checkbox"/> Other: _____

***Specification***

1. The abstract of the disclosure is objected to because it exceeds the maximum of 150 words. Correction is required. See MPEP § 608.01(b).

***Claim Objections***

2. Claims 1-25 are objected to because of the following informalities:

As for claims 1, 6, 14, 17, 22 and 25, acronyms (such as VLUN) should not be used to abbreviate key phrases until they are explicitly defined previously within the claim, or in a claim to which it depends. An example of an accepted correction would be "Virtual Logical Unit Number (VLUN)".

Claim 14 is additionally objected to as the phrases "the bitmaps" and "the log files" in lines 4-5 should be changed to "bitmaps" and "log files".

As for claim 25, the phrase "the target VLUN" in line three of this claim should be changed to "a target VLUN". In addition, the phrase "the original dirty data" referenced in line five should be changed to "original dirty data".

As for claim 16, the phrase "the target destage operation" should be changed to "a destaging operation".

Claims 2-5, 7-13, 15, 18-21 and 23-24 are objected to as they depend directly or indirectly on one of the above aforementioned claims.

Appropriate correction is required.

***Claim Rejections - 35 USC § 112***

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 9, 10, and 13-16 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

As for claims 10 and 13, the phrases "the first log file" and "the second log file" lack antecedent basis as no previous reference to either log files is presented in either claim (or in the claim (6) from which both depend).

As for claim 9, the phrases "the first bitmap" and "the second bitmap" lack antecedent basis for the same reasons as described with claims 10 and 13.

As for claim 14, the phrase "the snapshots" in lines 4-5 lack antecedent basis as no previous reference to "snapshots" are presented in this claim.

As for claim 16, the phrase "the dirty data designation" lacks antecedent basis as no previous reference to dirty data is presented earlier in this claim, or in the claim (14) from which it depends.

Additionally, the phrases "the log file" and "the bitmap" lack antecedent basis.

Claim 15 is further rejected as it depends directly on claim 14.

***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. Claims 1, 2, 4, 6, 7, 12, 17 and 19 are rejected under 35 U.S.C. 102(e) as being anticipated by Armangau (US Patent 6,434,681 B1).

As for claim 1, Armangau discloses a method of snapshot operation for a data storage system with a first host (Fig. 2, element 31) that communicates with a cache memory (Fig. 2, element 47) the cache memory is contained within the storage subsystem—see col. 8, lines 53-57), a source VLUN (Fig. 5, element 101), and a target VLUN (Fig. 5, element 103), comprising:

generating first metadata to locate first snapshot data and to

indicate when the first snapshot data is in the target VLUN (pointers (Fig. 5, element 106) are used to reference tracks in the snapshot volumes that contain the original data of the snapshot, col. 13, line 66 through col. 14 line 3); and

generating second metadata to locate second snapshot data and to indicate when the second snapshot data is in the target VLUN (the index (Fig. 5, element 111) acts as a translation table to indicate which track number of the production volume R corresponds the track number of the snapshot volume x—col. 14, lines 43-45), wherein the first and second metadata locate the same data in the target VLUN (the index and pointers refer to the same data in snapshot volume x—col. 14, lines 35-45; the index can also refer to the pointers themselves which are pointing to data located in snapshot volume x).

Alternatively, since each of the pointers contained in the list (Fig. 5, element 106) refer to a unique snapshotted production volume extent (track), each pointer within the list is a unique metadata referring to each snapshot (col. 13, line 67 through col. 14 line 7).

As for claim 2, Armangau teaches the method of claim 1, wherein generating the first metadata includes generating a first log file pointer to locate first snapshot data in the target VLUN (pointers (Fig. 5, element 106) are used to reference tracks in the snapshot volumes that contain the original data of the snapshot, col. 13, lines 66 through col. 14 lines 3).

As for claim 4, Armangau teaches the method of claim 1, wherein generating the second metadata includes generating a second log file pointer to locate second snapshot data in the target VLUN. Referring to Fig. 5, the

pointers referencing the data stored in snapshot volume x are contained in a list (element 106). As mentioned above, each pointer in the list points to a different track in snapshot volume x therefore each pointer itself is a unique metadata.

As for claim 6, Armangau teaches a snapshot system for a data storage system including a first host that communicates with a cache memory, a source VLUN, a target VLUN, and metadata, comprising:

- a source VLUN for active data (production volume R);
- a target VLUN to store migrated snapshot data (snapshot volume x);

first metadata to indicate when and to locate where the first snapshot data is in the target VLUN (pointers are used to point to the tracks in the snapshot volume that contain the original data of the snapshot (col.13, line 67 through col. 14 line 3). It is worthy to note that Armangau's system further includes a list of free track pointers (Fig. 5, element 109), which can be used to determine when data has been stored in the snapshot volume by removing the pointer from the list of pointers pointing to free tracks (col. 14, lines 3-7);

and second metadata to indicate when and to locate where second snapshot data is in the target VLUN wherein the first metadata and the second metadata to indicate and locate the same snapshot data in the target VLUN (again, the index (Fig. 5, element 111)) is used translate the production volume track number to the corresponding snapshot volume number. Armangau's index can therefore be further used to determine when snapshot data is in the

snapshot volume by checking the table to see if one or many of the production tracks correspond to the snapshot tracks.

As for claim 7, Armangau teaches the snapshot system of claim 6, wherein the first metadata includes a first log file pointer to locate the first snapshot data in the target VLUN and the second metadata includes a second log file pointer to locate the second snapshot data in the target VLUN. Just as with claim 4, each pointer in the list points to a different track in snapshot volume x, therefore each pointer itself is a unique metadata.

As for claim 12, Armangau teaches the snapshot system of claim 6, wherein the first metadata indicates that the original data of the first snapshot is in the target VLUN and the second metadata indicates that the original data of the second snapshot is in the source VLUN (each pointer points to the track location on the snapshot volume indicating where the original data is located (col.13, line 67 through col. 14 line 3)).

As for claim 17, Armangau teaches a method of snapshot operation in a data storage system in a first host that communicates with a cache memory, a source VLUN, a target VLUN, first metadata, and second metadata, comprising:

receiving requests from an application to modify data in the cache memory (col. 7, lines 1-6 the host requests modification of data in the primary storage area (cache) within the primary storage subsystem);

writing the modified data to the cache memory (modified data can be written once the remote copy flag is inspected by the primary storage subsystem – col. 7, lines 5-11);

destaging the original data to the target VLUN to preserve the original data of a first snapshot and a second snapshot (col. 7, lines 18-25 the data is copied from the primary storage area to a different set of primary storage locations (target VLUN));

and updating the first and second metadata to locate the original data in the target VLUN (the list of pointers as referenced in col. 7 lines 18-20 are used to locate data of both old and new versions of the storage units).

As for claim 19, Armangau teaches the method of claim 17, further comprising updating the first and second metadata to indicate the presence of the destaged original data in the target VLUN (again a pointer for each snapshotted track is used to locate the original data of the snapshot (col. 13 line 67 through col. 14 line 3)).

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Armangau.

Armangau teaches a method of an error recovery process in a data storage system wherein a first host verifies that original dirty data has or has not been destaged to the target VLUN, comprising:

(a) reading a bitmap wherein if the bitmap contains a 0 in a bit position representing the original dirty data in cache memory (note col. 8, lines 52-57 the primary storage within the production volume can contain SRAM which is serving as a cache memory), destaging the data to the target VLUN, and wherein if the bitmap contains a 1 in a bit position representing the presence of associated original data in the target VLUN, not destaging the data (col. 4, lines 24-40, determining whether or not the data has been modified is performed by reading the status of the bit. Further, storage space is allocated for the data to be copied to the snapshot location);

(b) removing the dirty data designation for the destaged data (col. 4, lines 41-43; changing the bit in the bit map); and

(c) repeating the steps (a) and (b) until all of the original dirty data is destaged (col. 16, lines 30-34; a track copy pointer is used as a place holder which steps through all of the tracks of the production volume until the entire volume has been searched for modified data).

Though Armangau does not explicitly teach that the bitmap must contain a "0" to destage the data, and a "1" to not destage the data, such limitations are merely a matter of design choice and would have been obvious in

the system of Armangau. These limitations fail to define a patentably distinct invention over Armangau since both the invention as a whole and Armangau are directed at determining to write modified data to the snapshot volume based on the status of a similar binary bit.

***Remarks***

6. No prior art has been applied to claims 9-10, and 13-16 due to the ambiguities set forth above in the rejection of the claims under 35 U.S.C. 112 second paragraph.

***Allowable Subject Matter***

7. Claims 3, 5, 8, 11, 18, and 20-24 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.
8. The following is a statement of reasons for the indication of allowable subject matter:

As for claim 3, though Armangau teaches the use of a bitmap in his system to determine which data in the production volume has been modified, the bitmap as taught by Armangau fails to indicate when the modified data in the volume has migrated to the snapshot volume as claimed by applicant.

Sicola et al. (US Patent 6,618,794 B1) teaches a system for point-in-time copy of data in a data storage system which utilizes a bitmap to indicate if the data from the source (LUN X) has migrated to the target (LUN Y), col. 1

lines 50-56), however there is no reasonable motivation to combine two these teachings.

As for claim 8-10 and 13, though Armangau teaches maintaining a log file to indicate when snapshot data has migrated to the snapshot volume, he does not teach the use of a second log file, nor does he include the use of either one or two bitmaps for the purposes of indicating when snapshot data migrated to the snapshot volume.

As for claim 11, though Armangau's system provides a means for both first and metadata to indicate that snapshot data remain in the target VLUN (by use of a pointer and an index), his teachings do not include using the metadata to indicate that snapshot data remain in the source VLUN.

As for claim 14, again though Armangau teaches the use of log files containing pointers to locate data in the snapshot volume, he fails to teach the use of multiple log files and multiple bitmaps as claimed by applicant in lines 4-5.

As for claims 18 and 20, though Armangau teaches storing first and second metadata of the target VLUN, he fails to teach destaging the metadata to the VLUN itself.

As for claim 21, Armangau does not teach the limitation of destaging the modified data back to the source VLUN.

As for claim 22, again Armangau does not teach the use of multiple bitmaps in his system.

Claims 5, 15-16, and 23-24 further limit claims 3, 14 and 22 respectively therefore they too are deemed allowable.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Craig E. Walter whose telephone number is (571) 272-8154. The examiner can normally be reached on 8:30a - 5:00p M-F.

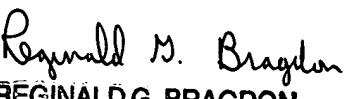
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mano Padmanabhan can be reached on (571) 272-4210. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Craig E Walter  
Examiner  
Art Unit 2188

CEW



REGINALD G. BRAGDON  
PRIMARY EXAMINER